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Tunnel Boring Machine

Lead: For centuries engineers have searched for a way to tunnel through the earth to remove obstacles to human progress. In the early 1950s, James Robbins invented the first successful TBM, tunnel boring machine.

Intro.: *A Moment in Time* with Dan Roberts.

Content: The techniques have been as numerous as they have been clever. As early as 2000 BCE, Egyptians mined mountains for copper and gold by splitting rock heated first by fire,

then cooled by water. Absent that ability, excavators were forced to chip away at dirt and rock with hand tools. In the early modern era, explosives such as gunpowder led the way though the tailings or residual rock had to be carted away from the front of the cut. Gunpowder blasts made possible an underground section of a French Mediterranean Sea to Atlantic Ocean canal/waterway system in 1679.

For the next three centuries, a series of spectacular failures punctuated the tunnel boring business. In 1846 Henri Maus invented a "mountain slicer," for a railroad tunnel between France and Italy. It stalled. A few years later "Wilson's Patented Stone-Cutting Machine,"

ground to halt after drilling just ten feet into the Massachusetts mountains for the Hoosac Tunnel. After that, compressed air drills helped speed things up a bit and explosives were improving. Nitroglycerine was used in 1867, the year Alfred Nobel, Swedish physicist and philanthropist secured a patent for dynamite.

The ultimate solution did not come until the early 1950s. Contractor F.K. Mitty won a bid to build a dam near Pierre, South Dakota before he figured out a way to dig through the fragile, loose shale that inhabited the site. He hired mining engineer James Robbins to solve the problem. In 1953 Robbins delivered his first TBM, 90 feet long, 26 feet wide, 125 tons, with groups of

rotating metal tines to shatter the shale, and above them "wedging" or "bursting" wheels to whisk away the tailings. "Mitty's Mole" cut through 160 feet of shale in 24 hours, 10 times faster than any other method. Mitty ordered more, but his "mole" worked only in soft rock, like Pierre shale.

Robbins who had then formed his own company went back to work and found that the wheels, renamed "cutter disks," were doing the work all along! Today, approximately 120 tunnel boring machines are at work around the world. Each can move 4,000 linear feet of rock per month. In June 2007, a 23 foot-Robbins TBM digging in Iceland moved 348 feet in 24 hours.

At the University of Richmond, this is Dan Roberts.

Resources

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